Vacuum Packaging (VP) and Reduced Oxygen Packaging (ROP) of Foods

By Dr. Olga Padilla-Zakour, Cornell University

You have seen it advertised in the television commercials: vacuum packaging will extend the life of both dried and refrigerated foods. You talk to a VP machine supplier and he promises to double the shelf-life of your refrigerated product. But before you buy the unit, you must understand the safety concerns, limitations and regulations that cover this packaging option.

Definition of Reduced Oxygen Packaging (ROP)

Any packaging procedure that results in a reduced oxygen level in a sealed package is considered ROP, including vacuum packaging. The air we breathe has approximately 21% oxygen and therefore any packaging option that results in less oxygen is classified as ROP. In general, ROP offers advantages such as extended shelf-life and improved quality retention but it also raises many microbiological concerns. A Hazard Analysis and Critical Control Points (HACCP) program is currently mandatory or recommended for this type of packaging depending on the kind of foods being processed.

Benefits of ROP

The anaerobic environment (no oxygen) prevents the growth of the typical spoilage organisms that need oxygen to grow (aerobic microorganisms) and that are responsible for off-odors, slime, and texture changes. It also reduces oxidation of foods, retards rancidity and color deterioration and gives a “Fresh-Never Frozen” appeal for refrigerated products.

Microbiological Hazards of ROP

The main consideration is given to a bacterium called Clostridium botulinum that produces a deadly toxin or poison that, if ingested, causes a potentially fatal condition called botulism. This bacteria requires low acidity, meaning a pH higher than 4.6, and the lack of oxygen or air (anaerobic conditions) in order to grow and to produce the toxin in a food. That is why vacuum packaged products are always subjected to a safety evaluation regarding this bacterium before a retail product is allowed in the marketplace. If the conditions are not suitable for this bacterium to grow, then the spores remain dormant and there is no health concern. C. botulinum is very resistant to heat because it produces spores that survive boiling temperatures. To destroy the spores, the product needs to be heated under pressure to achieve higher temperatures, as occurs during the commercial canning of vegetables. Some types of C. botulinum can grow slowly at refrigerator temperatures but the bacteria grow better at room temperatures. The spores are present everywhere and therefore

VENTURE

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HOT STUFFING:
EVENTS YOU DON'T WANT TO MISS

December 3, 2001 - 2 Locations!
Commercial Production of Jams & Jellies for Retail Markets
FoodScience/ NYSAES, Geneva, NY
Elizabeth Keller: 315-787-2274
University of Vermont, Burlington
Cecelia Golnazarian: 802-656-0147

January 8-9, 22-23,
February 19-20, 2002
Next Level Training:
Tilling the Soil of Opportunity
(Business training for agricultural and value added enterprises)
Cheryl Leach: 315-787-2622

March 26, 2002
Suppliers Night Food Expo
(Free admission)
Rochester Riverside Convention Center
Rochester, NY
Sponsored by Western New York Institute of Food Technologists
Judy Anderson: 315-787-2273

May 6-9, 2002
Better Process Control School
Acidified Foods - May 6-7
Low Acid Foods - May 6-9
Ramada Inn Geneva Lakefront, Geneva, NY
Judy Anderson: 315-787-2273
Seven years in the small-scale food processing business have brought Deb Dechert and her company, Deb’s Delights, from four pickled products sold at farmers’ markets to national recognition, retail outlet opportunities in several states and a line of 40 specialty food products.

Deb’s Delights began operations in 1994 at the suggestion of friends and family who loved Deb’s canned goods. In order to spend time with her children, Deb turned the basement of her East Aurora, NY home into a processing facility inspected several times each year. Business startup also involved pursuing product process approval from what was then the New York State Food Venture Center (now NECFE) and registering her business with New York State and the NYS Department of Agriculture and Markets. Deb took the Better Process Control School in 1995 to gain certification for making pickled products.

Deb’s Delights is a true family operation pulling distribution assistance from her husband, labeling design and assistance from her mother, and produce from family gardens. Deb often works well into the night preparing, processing and packing her products. Although she would like her business to remain small until her children leave home, sales continue to grow by 20% each year. In anticipation of rising national demand, she has registered for UPC codes, set up a web site (www.debs-delights.com) and became incorporated.

“At this point we’re having a hard time keeping production up with sales,” she says. “People enjoy my products which is very gratifying.”

Deb has let her creative side fly, branching into unique specialty goods like raspberry/jalapeno pepper jelly, and zucchini relish. Her Habanero Honi line of fiery pickles, garlic and pepper jelly gained wide-spread attention when she won second place in the 2001 National Fiery Food Challenge operated by Chile Pepper Magazine. But Deb is quick to point to local support of her endeavors.

“I am a hometown girl so local businesses have been very interested in carrying my products. When I first started and I was selling my products at the local farmers’ markets, I was interviewed three times by the local Buffalo TV stations. There was a lot of interest in what I was doing.”

Her advice to small-scale food entrepreneurs just getting started in the business? “If it is a dream, go for it. Love what you do and enjoy it. And do it right. Go through the right authorities. Go by the book.”
any food can be contaminated with *C. botulinum*. It cannot grow if the amount of free water available in the food is restricted to such a level that the water activity is below 0.93. This condition can be achieved by water removal from the food product (by drying or evaporation) or by the addition of water soluble ingredients such as salts and sugars that have the ability to bind the free water.

**Types of ROP**

Most ROP foods can be produced by one of the following procedures.

- **Vacuum Packaging**: reducing the amount of air from a package by pulling a vacuum and hermetically sealing it. Also includes vacuum skin packaging. Normally done by VP machines. Examples: vacuum packaged dry foods.

- **Controlled Atmosphere Packaging**: active system that continuously maintains the desired low oxygen atmosphere within the package. In this case, agents that bind oxygen or compounds that emit a gas are incorporated in the package. Example: controlled atmosphere (CA) storage of apples.

- **Modified Atmosphere Packaging**: gas (with little or no oxygen) flushing and sealing or reduction of oxygen through respiration of produce or through microbial action. Represents a one-time modification of the gaseous composition inside the package. Example: refrigerated fresh cut produce in bags.

- **Sous Vide**: vacuum packaging of raw or partially cooked foods, followed by pasteurization (low temperature cooking) to reduce the microbial load and rapid refrigeration/freezing. Reheating to a safe temperature before consumption is required. Not very common in the USA.

- **Cook-chill**: process that uses a plastic bag filled with hot cooked food from which air has been expelled and which is closed with a plastic or metal crimp (similar to hot-filled). Example: refrigerated bagged soups for the food service industry.

**Safety Concerns**

The extended shelf-life offers the opportunity for pathogens to grow slowly. Refrigeration is often used with ROP as a way to control microbial growth but the required temperatures (below 41°F) are difficult to maintain during distribution, at retail stores and homes. Pathogens such as *Listeria monocytogenes*, *Bacillus cereus*, *Salmonella* spp., *Staphylococcus aureus*, *Vibrio parahaemolyticus*, *Campylobacter* spp, and *Brucella* spp., can survive for long periods of time and even grow slowly if the food product is under marginal refrigeration or mild temperature abuse. Indeed, the anaerobic conditions under ROP favor the growth of *Clostridium botulinum* and if spoilage organisms are not growing to indicate the end of the shelf-life, the food could appear acceptable even though pathogens are present. Pasteurization of ROP foods will not destroy spores of *C. botulinum* and may actually select for it.

Examples of foods that cannot be ROP because of their high inherent risk of *C. botulinum* include raw mushrooms, raw fish and seafood products.

**Safety Guidelines for ROP**

Use ROP for foods that do not support the growth of *C. botulinum*, that is:

- Foods with a water activity below 0.91 – like dried spices and dried nuts.
- Foods with a pH of 4.6 or less – like pickles, sauerkraut, most fruit products.
- USDA inspected and cured meat which has salt (brine concentration of 3.5% or more), and nitrates and nitrites (120 ppm of sodium nitrite) – such as ham and bacon.
- Frozen foods with the labeling statement “Important-Keep Frozen Until Use”.
- Control Atmosphere Packaging that maintains enough oxygen to control the growth of *C. botulinum*.

In addition, the following precautions should be implemented:

- Refrigerated ROP should have a maximum of 14 days shelf-life clearly marked in the label.
- Refrigeration temperatures of 41°F or below should be kept and indicated in the label - “Important: Must be kept refrigerated at 41°F (5°C) or below.”

**Current regulations specify the need for two barriers against *C. botulinum* and other pathogens for ROP foods.** Acceptable barriers are:

- Refrigeration.
- pH below 4.6.
- Water activity below 0.91.
- Use of oxygen permeable film.
- Presence of high level of non-pathogenic competing microorganisms (raw meat, fermented cheeses containing live cultures).
- Freezing.

**Regulations for ROP**

FDA and USDA have guidelines specified in the 1999 Food Code and most states have equal or similar requirements. In most cases, a processor must file a petition to the Department of Agriculture and Markets or the Department of Health to produce ROP foods. In addition, proper documentation must be kept.

**References**


Would You Be Ready for a Disaster?
by Judy Anderson, Cornell University

In light of the recent terrorist attacks in New York City and Washington, the NECFE staff felt that a brief article on the subject of disaster preparedness was appropriate. The reference article used here deals with natural disasters affecting restaurants, but most of the recommendations would apply to any situation and any food processing operation.

Having a written disaster plan in place and easily accessible before it is needed is the best way to lessen the damages your business will suffer. It would also be helpful to periodically do a “practice” run to make sure you and your employees know how to implement the plan.

Disasters come in many forms, both natural and accidental and you need to anticipate what kinds of disasters might befall your area. Different parts of this country are more likely subject to tornados, floods, hurricanes and earthquakes. Accidental disasters would probably be more localized and might include things like fires, chemical spills and nuclear accidents. These require specialized preparation and cleanup and except for fire, this article won’t get into them.

Disaster Kit.
Part of a good disaster plan is a disaster kit. There are four things you should always have ready.

1. A flashlight. It should have at least 2 or 3 “D” cell batteries and they should be working. Check it at least monthly to be sure it’s working and replace the batteries every 6 months regardless of their condition. You may need the flashlight to refer to your disaster plan.

2. Battery powered radio. You will need to keep up on the events in your area. Up-to-date information can be invaluable. Don’t rely on someone else to tell you what’s happening. Some people exaggerate events to make conversation more interesting.

3&4. Pencil and Paper. You will need to make notes on various topics – phone numbers for disaster relief, refrigerator/ freezer temperatures, times, etc.

Other items that may prove useful are various kinds of tape for reinforcing windows or making repairs, first aid supplies, water purification tablets or bleach, a couple of blankets, cans of food that won’t be harmed by water, matches and a copy of your disaster plan.

The Disaster Plan.
Some of the things to consider when writing your plan are:

To start, take a good look at your physical plant or facilities. Is your equipment powered by gas or electricity or both? If you needed to shut off the gas or power quickly, could you do it? Do you have equipment mounted on the roof or in the basement where it is most likely to be flooded?

Utilities. Know where the main switches and cut-off valves are located and how they work. A broken gas line is a sure road to further disaster. Total loss of power often means that the voltage will be lower when the electricity is restored and that can damage equipment. Always turn the switches on equipment to “OFF” then throw the main breaker switch, too. It’s even better if this can be done before the emergency happens. Have an electrician test the voltage before turning the equipment back on.

Gas equipment should be checked before and after the gas supply is restored. Don’t forget to re-light pilots. In the event of a fire, turn off the main power switch to help prevent the spread of fire through the system.

Refrigeration. In case of power loss, try to estimate the length of time the power will be out. For just a few hours, keeping the refrigerator or freezer doors tightly closed will usually maintain a sufficiently cold temperature to avoid product loss. Monitor cooling equipment to be sure the temperatures don’t move into the danger zone (above 41°F). If the power will be out 24 hours or longer, look for alternate storage. A refrigerator/ freezer truck may be necessary. Check into their availability before a disaster happens. If the available trucks are too big for your needs, try to find another entrepreneur who would also need one and plan to share it.

Frozen food can be kept frozen with dry ice for 2-3 days. Look for suppliers and have the contact numbers ready for an emergency. Plan on using 200 lbs. of dry ice in a 10’ x 10’ freezer. When using dry ice, always wear gloves to handle it, and DO NOT enter the freezer until the carbon dioxide has been cleared from the room (open the door for 15-20 minutes).

Roof. Inspect roof-mounted equipment for loose fastenings, missing panels or any other damage. Equipment kept in good repair will be less likely to sustain heavy damage. Inspect the roof itself and replace damaged or loose shingles or panels. Remove any loose object or debris that might fall or block water drainage. Check gutters and downspouts to be sure they are clear and in good repair.

Water Supply. If the water supply is interrupted, it should be checked for potability before you resume operations. The local health department is probably your best source of information on the condition of the water supply.

Drains & Sewage Disposal. Supplies and equipment stored near the floor should be moved to higher “ground” if there is a chance of drains backing up. Any food products coming in contact with sewage effluent should be destroyed.

Emergency Lighting. Emergency lights that come on automatically when power fails are great, but remember that most only have a 2-3 hour lifespan. Keep your flashlight handy and DO NOT use candles, especially if you have gas service in your facility.

Garbage Removal. Try to have all garbage removed as soon as possible to prevent off-odors and vermin infestation. Consider the use of pesticides if necessary, but it would be best to have them professionally applied.

Sanitizing. Have a plan in place for resanitizing all food contact surfaces. Cleaning up after a disaster will require more aggressive tactics than your normal sanitizing procedures.

Reuse of Food Products and Supplies
All food must be examined closely
McCormick releases
Food Craving Study data

McCormick & Co., Hunt Valley, Md., released the results of a consumer study it sponsored on American’s food cravings. The study indicates major difference in food cravings between various groups. The study, called Crave It! (TM), was designed to further understand consumer food and flavor cravings. Conducted by Moskowitz Jacobs, Inc. and The Understanding & Insight Group, the study was completed in September 2001. It investigated consumer cravings for many different foods. Some interesting results from the study indicate important food craving differences between men and women as well as regional differences. The data reveals that men crave steak and ribs, while women long for chocolate candy and ice cream. Regional effects show that Northeasterners crave pretzels and pizza, while Southwesterners crave cheese and BBQ ribs. Both men and women report taste as the number one driver of cravings. When asked what else drives their cravings, however, the answers diverge. Men report that it’s aroma, and women say texture. Adding flavors can increase cravings, especially for meats. Hickory-smoked, mesquite-smoked, spicy-coating or a flavorful sauce, all increased cravings for these foods. For more information, see the McCormick Flavor web site (http://www.mccormickflavor.com/).

From: IFT weekly Newsletter, Oct. 22, 2001

Disaster Plan Check List

Evacuation
See that all employees and other building occupants get out safely.

Supplies
Flashlight    ☐ Pen & Paper    ☐ Battery Operated Radio    ☐
Blankets    ☐ Emergency telephone numbers    ☐ Reinforcing Tape
First aid Supplies

Utilities
Shut off electricity    ☐ Shut off gas at main supply valve
Turn all equipment switches to OFF    ☐ Turn off all water faucets or outlets

Actions
Secure and anchor all large equipment if possible    ☐ Secure all small objects (knives, pans, etc.)
Arrange for refrigerator or freezer space if necessary    ☐ Order dry ice if appropriate
(trucks if appropriate)
Check readings on all temperature gages to have a baseline reading for comparisons.

Emergency Numbers
Police    ☐ Fire    ☐ Red Cross
Civil Defense    ☐ Electric Utility    ☐ Gas Utility
Water    ☐ Sewer    ☐ Other
Electrician    ☐ Generator rental    ☐ Plumber
Truck Rental    ☐ Dry Ice    ☐ Equipment Rental
The Open House at the Northeast Center for Food Entrepreneurship (NECFE) on Friday, August 17, was a taste and tell event that attracted over 80 entrepreneurs from throughout the Northeast. Some, like Roger and Marcy Lloyd of Fairport, were in the idea stage of introducing a new processed product into the niche market arena. Others, like Juan and Maria Contreras, who already own a successful take-out restaurant and lunch cart in East Rochester, were considering introducing new products into their locally popular line of foods.

NECFE helps people who have an idea for a new food product or food processing business test their idea, safely formulate their recipes, and develop a sound business plan before launching their product. The partnership between the Food Venture Center at Cornell, which was established in 1988, and the Center for Food Science at the University of Vermont was funded by a $3.8 million, four-year grant from the U.S. Department of Agriculture in 2000.

“We are pleased that so many of our hard-working and innovative entrepreneurs were able to attend at such a busy time of year,” said Olga Padilla-Zakour, NECFE director. “Everybody was very impressed with the program and the facilities.” She said the marketing seminar was “a tremendous success,” and was encouraged that assemblymen Brian Kolb and Clifford Crouch, and David Fellows, special assistant to the commissioner of Ag & Markets, were able to participate in “active dialogue” with so many New York entrepreneurs. The event may be incorporated into NECFE’s workshop schedule as an annual event.

“The NECFE Open House shows the progress that can be made when the university works as a partner with the private sector,” said Director Jim Hunter. “The event and the work of NECFE show the importance of having dedicated and technically competent staff, without which success would be impossible.”

In the marketing seminar, Jacqueline Beckley and Melanie Cushman, of the Understanding and Insight Group, stressed the importance of market research, analyzing the competition, developing a business plan, and the product development process.

“I’m going to implement some of the ideas from the presentation this morning as soon as I get back,” said Contreras. Like others, he cited “new resources,” “more ideas,” “networking,” and “things we hadn’t thought about” as some of the real benefits of attending the Open House.

David Fellows, from the NYS Department of Agriculture and Markets, Assemblyman Brian M. Kolb (R-129, Canandaigua), and Assemblyman Clifford Crouch (R-122, Brainbridge) participated in the panel discussion on the “Impact of Food Entrepreneurship on Economic Development.” Both legislators sit on several assembly committees and were very interested in hearing about the issues facing would-be entrepreneurs. The dialogue was brisk. It focused on New York’s burdensome regulatory environment, increasing the marketing opportunities for New York products, and developing cooperative distribution networks for small and medium-size New York producers.

In the processing business, nothing speaks louder than the smell and the taste of the foods themselves. At noon, entrepreneurs, legislators, Station employees and members of the public lined up in the Vinification and Brewing Lab to sample over 30 specialty food products provided by entrepreneurs who have worked with NECFE. Products included BBQ sauces, savory salsas, stuffed olives, pickles, jams, goat cheese, jerky, salami, smoked turkey, goat milk ice cream, yogurt, Chai tea, fresh fruit juices, crackers, mustards and more. Tastes ranged from the fiery to the piquant, salty to sweet, and cold to hot.

At the same time, Edgar Ralph Moss and his partner Robert Wright, Ellen, Mary and Jason Knapp, and Daniel and John Corsaro participated in a steamy demonstration of small-scale processing in the Fruit and Vegetable Research Pilot Plant. They provided bottled samples of BBQ sauce, apple cherry juice and Italian salsa for people to take home.
The Center for Food Science of the University of Vermont, a partner in the Northeast Center for Food Entrepreneurship (NECFE) held an open house in Burlington on Wednesday, August 15, 2001 at the University of Vermont.

The open house program in Vermont was key-noted by the Honorable Senator Patrick J. Leahy (D-VT). Guests were welcomed to the event by Edwin I. Colodny, Interim President of the University of Vermont and former Chairman of U.S. Airways. We were pleased to have Dr. Colien Hefferan, Administrator of Cooperative State Research, Education, and Extension Service/United States Department of Agriculture and Connie Stanley-Little, Director of the Economic Development Council of Northern Vermont, Inc. as guest speakers.

Guests were invited to taste test an array of Vermont specialty food products and to visit exhibits by resource providers. The day’s menu included scrumptious desserts by the Dessert Divas of Stowe Vermont, Vermont Specialty Cheeses from Cabot, pulled pork sandwiches featuring the Southern Sauces of River Run in Marshfield, and braised Ethiopian Savory Chicken Crepes featuring products of Tektonic Palates and the Gourmet Creperie. Guests were able to visit with resource providers from the Vermont Department of Health, the Vermont Food Venture Center, the Economic Development Council of Northern Vermont, and the Women’s Agricultural Network (WagN). The day was topped off with Ben & Jerry’s Homemade Ice Cream served with assorted toppings by The Mapled Nut, Maple Passions Fruit Syrups from Hillside Lane, and Green River Chocolates sauces.

The event was well attended by a crowd of 250+ people. We received wonderful coverage from the press, The Burlington Free Press and New England Country. Folks as well as television coverage with CBS (WCAX TV), ABC (WVNY) and NBC (WPTZ). The Burlington Free Press (Tuesday, 8/21/01) later published an editorial praising the NECFE efforts and WCAX TV will air an “Across the Fence” show regarding the NECFE on Friday, November 9, 2001.

Americans do enjoy cooking, at least to a degree, according to a report based on a representative sampling of the U.S. population by Market Facts Inc., reported Feedstuffs (Sept. 24). Thirty-eight percent of people “love” to cook and 46% “don’t mind” preparing meals, while the remaining 16% consider it a “chore”. The major motivators in deciding what to buy and fix for meals are taste, which was ranked as the top motivator by 33% of those surveyed, family preference (29%), convenience (15%) and nutrition (15%). Cost was ranked at the bottom of the five motivators. Fifty-nine percent of people wait until the day of the meal to decide what to fix for the meal, 29% wait until two hours before dinner, 23% decide the evening before, 12% earlier in the week and 6% plan an entire week’s menu at one time. Thirty-seven percent surveyed “always” or “often” use recipes to decide what to fix for dinner, while 60% “sometimes” use recipes. The top solutions wanted in recipes are meals that can be prepared quickly (82%), meals that are healthful (57%), recipes that use just a few ingredients (47%), recipes that update common dishes (32%), ethnic recipes (21%), recipes that can serve several people (16%) and recipes that can fit special dietary needs (14%).

From: The Food Institute: Telephone # 201-791-5570.
To promote Pride of New York Products of all kinds, the Small Scale Food Processors Association will assemble “Pride of New York Gift Baskets” with many various themes at the Adirondack Kitchen Project Inc. We have the ability to store and package products as well as accept “secure” credit card purchases so payments will be made and credited properly prior to shipping the baskets. We plan to deliver these baskets by UPS and/or FEDEX either regular way or next day if the purchasers require immediate delivery. We also plan to use low income, disabled or recently unemployed individuals to participate in this project.

These “Gift Baskets” will have the following goals:

• To use the Pride of New York concept to promote buying quality New York products of all kinds.
• To assist and promote as many New York products as possible through the Gift Basket concept.
• To have numerous types of Gift Baskets so that as many products as possible can participate.
• To make it possible for the consumer to buy direct from the producer any product in the “basket.”
• To provide and promote exposure of individual products as broadly as possible.
• To provide credit card purchases of the Gift Baskets so there is no risk to the participants.

The products used must be shelf stable and safe to stand at room temperature prior to being opened by the purchaser of the Gift Basket (such as: certain dairy products-cheeses etc., beef products, processed foods, certain specialty food products, crackers, wines etc.) So that we can promote as many products as possible, we have to limit the product container or package size to “wine splits” and 16 oz. wt. or volume containers. We may find that in some cases smaller sizes will be required. We are a not-for-profit organization and plan to work and supply these baskets on a “recovery cost basis” as much as possible.

We would need the producer to supply their products for the “baskets” as follows:
1. Producer must be a member of the Pride of New York program.
2. Producer must also be a member of the Small Scale Food Processors Association.
3. Delivered to the Adirondack Kitchen at the producer’s expense.
4. Product is to be provided at no cost and producer will be paid monthly for product/s sold in baskets.
5. Cost of product/s for supplying baskets not to exceed producers normal wholesale costs.
6. Proof of Product Liability Insurance ($1,000,000 minimum) will be required.
7. Write-up and/or brochure on your product/s so the purchaser of the basket can contact you directly if desired.
8. A signed agreement will be required releasing the Adirondack Kitchen Project Inc. and other basket participants of any liability regarding somebody’s else product/s used in these promotion baskets.

Anyone interested in having their products used in these “Gift Baskets,” please contact: Dave Evans, Adirondack Kitchen Project Inc., 2024 Connecticut Road, Plattsburgh, NY 12901; 518-561-0751 email: evansd@together.net